SHELTERWOOD METHODS OF PINE THINNING IN MISSOURI

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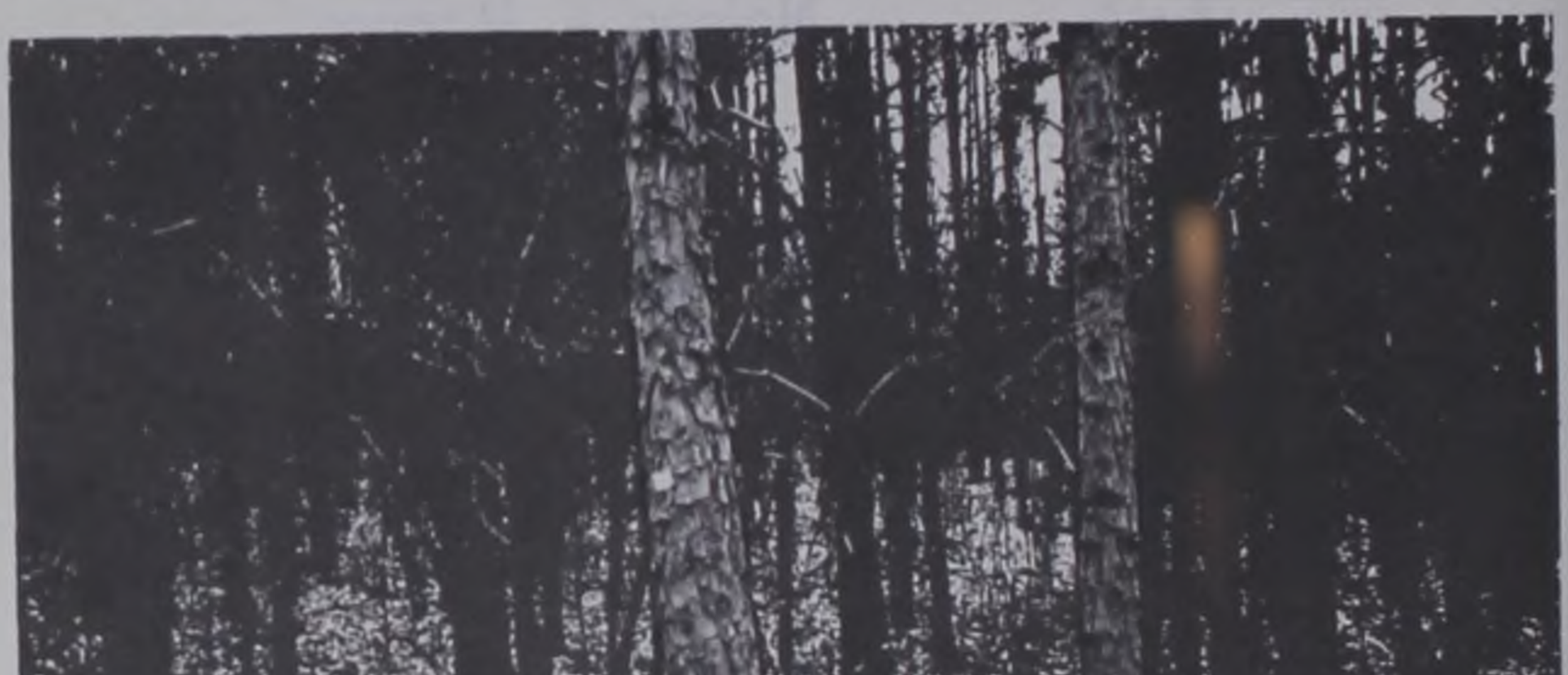
Few trees in young, even-aged, natural pine stands have dominant crowns. Certain trees may have larger crowns and correspondingly larger stem diameters, but in general the crown canopy is uniform. Trees of the same age are nearly equal in total height even though stem diameters of the trees in the main stand may range from 4 to 9 inches. In thinning such stands the problem arises which trees to leave (fig. 1). If the small trees are removed, the residual stand will consist of fewer but larger trees than if the larger ones are removed. But removing the small trees may not be commercially feasible. Removing the larger trees will yield higher valued products but may also eliminate genetically superior trees. The only way to resolve the question was to try both methods and see.

FIGURE 1. — The study area in 1951 showing the high density of shortleaf pine before thinning. One of the two trees in the center foreground should be removed because they are too close (less than 2 feet apart) for good growth and development. Both trees have a desirable stem form but the tree on the left (A) is 8 inches in diameter and will yield one pole (class 6 or 7) and two fenceposts, whereas the tree on the right (B) is only 5 inches in diameter and will yield two 7-foot posts.



THE STUDY AREA

The study was conducted in a pine-oak stand on the Sinkin Experimental Forest, Dent County, Missouri. The stand is located on the tops and sides of two main ridges. Slope ranges from 4 to 30 percent. The soil is classified as Clarksville stony loam. Site index is 60 to 65, about average for shortleaf pine in Missouri.

The stand developed naturally after harvest of an oak-pine stand about 1918. Since 1933 this area has been a part of the Clark National Forest and has not been burned. Most hardwood trees in the stand were cut or girdled in 1934 and the pines were thinned from about 1,100 to 600 trees per acre.

This early thinning eliminated the poorest pine trees, removed most competing hardwoods, and left the better pine trees free to grow. By 1951, however, the need for another thinning was indicated by reduced diameter growth, complete crown closure, and the presence of many overtopped trees.

Pine trees ranged in diameter from 1 to 12 inches, averaging 6.4 inches. Dominant and codominant trees were about 50 feet tall. Pine basal area averaged 138 square feet per acre.

Most hardwoods had resprouted by 1951 — when the stand was about 30 years old. The stands contained about 900 hardwoods per acre 0.6 inch d.b.h. and larger with a basal area of 14 square feet. In addition, there were about 3,500 smaller hardwood stems per acre. The most numerous understory species were black oak (*Quercus velutina* Lam.), white oak (*Q. alba* L.), sassafras (*Sassafras albidum* (Nutt.) Nees), and dogwood (*Cornus* L. spp.).

Thinning Methods

Each thinning method (thinning from above and thinning from below) was replicated three times on ½-acre plots. In selecting pine trees to leave, primary consideration was given to tree size. In thinning from above the smallest trees were left; in thinning from below the largest trees were left. Both thinnings left the best possible trees, those with single, straight, well-formed boles that were free of large knots and other surface defects. These procedures were modified only when they would have resulted in poor spacing of leave trees. All stands were thinned to 70 square feet of basal area. All plots had some hardwoods present, mostly oak saplings in the understory. The larger hardwoods were cut and the foliage of small trees and sprouts was sprayed with 2,4,5-T to remove any confounding effects of thinning method and hardwood competi-

tion. Additional foliage spray was applied in 1955 and 1959 to further control understory hardwoods.

In 1961, ten growing seasons after the first thinning, the plots were again thinned to 70 square feet of basal area. The same methods of thinning were used.

Residual Stand Conditions After the First Thinning

Thinning from above yielded the most volume (table 1) and left about 120 more trees per acre than thinning from below (fig. 2). In the stands thinned from above the average tree diameter was reduced by more than ½ inch whereas thinning from below increased the average tree diameter by more than 1 inch.

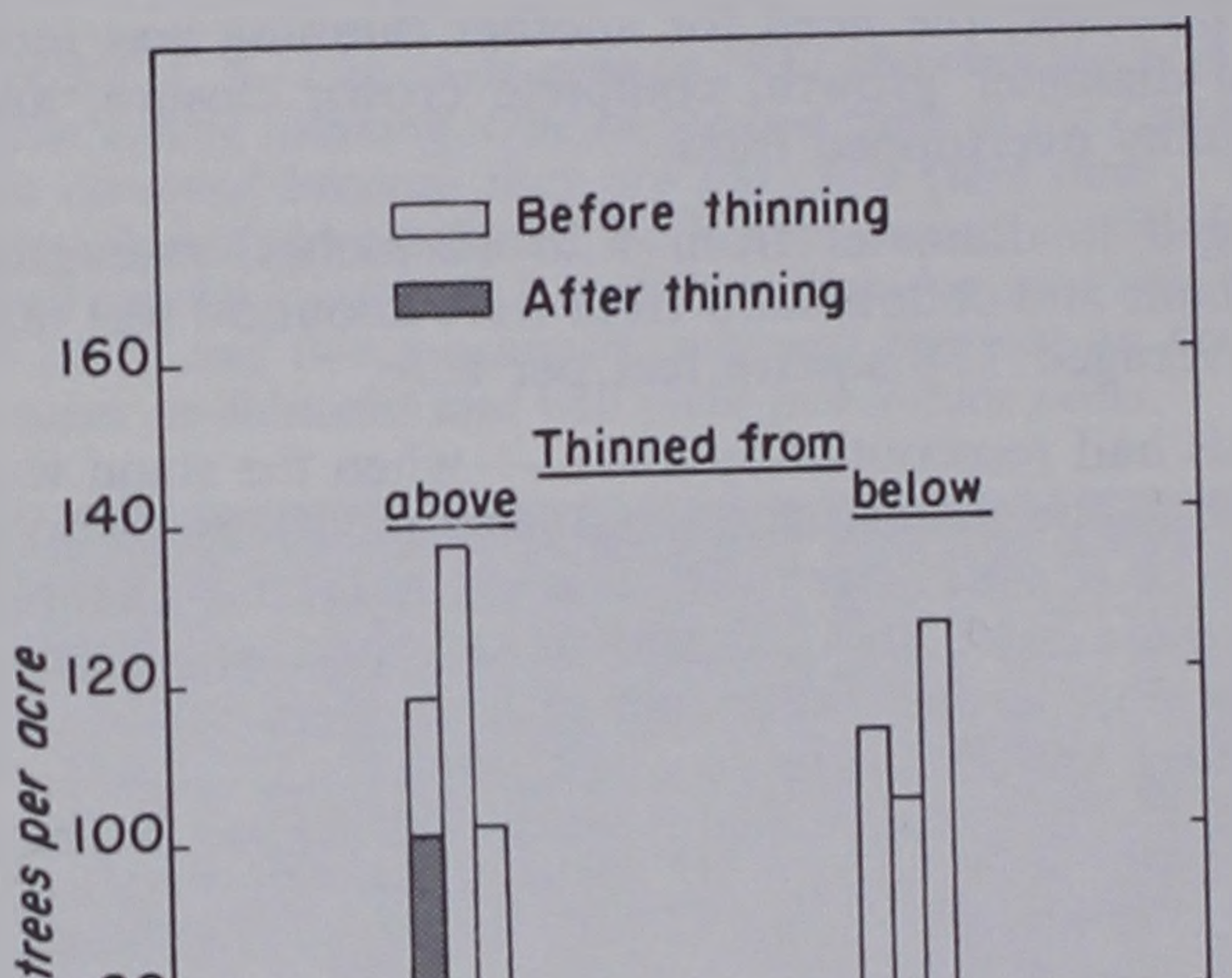


FIGURE 2. — Distribution of pine trees as affected by thinning method.

Table 1.--Pine stand conditions before and after the 1951 thinning

(Per acre)

Thinned from--	Basal area in square feet		Number of trees		Cubic-foot volume 5 inches d.b.h. and larger[1]		Board-foot volume 7 inches d.b.h. and larger[2]	
	Before	After	Before	After	Before	After	Before	After
Above	142	70	575	348	2,265	1,020	6,450	1,980
Below	122	70	556	227	1,855	1,220	4,700	3,870

1/ To a 3-inch top (d.i.b.).
2/ To a 5-inch top (d.i.b.) (International 1/4-inch rule).

10-YEAR RESULTS

During the 10 years of the study so far, stands thinned from below grew at about the same rate and showed similar responses to treatment. Although stands thinned from above grew at least as well as the others, a realistic evaluation of the long-range effects of thinning methods cannot be made on the basis of growth during this first 10-year period.

Basal-area growth was similar in all stands regardless of thinning method (table 2). Although total stand basal area increased somewhat more in stands thinned from above, this growth was divided among the more numerous small trees.

Mortality due to ice storms was higher in the stands thinned from above, partially because of the root and crown characteristics of the residual trees. The 1961 thinning maintained the earlier differences in number of trees between treatments.

Thinning from above in 1961 eliminated most of the trees larger than 8 inches and reduced average stand diameter from 7.4 inches to 6.8 inches. In contrast, this second cutting increased average diameter in the stands thinned from below from 9.2 inches to 9.8 inches. This difference of 3 inches in average tree diameter will increase saw-log rotation in the stand thinned from above by about 20 years at current growth rates (fig. 3) even though thinning is done from below from now on.

Table 2.--Effect of method of thinning on total growth and yield (including mortality) from 1951 to 1961 (all hardwoods were eliminated)

(Per acre)

	Thinned from--	
	Above	Below
Basal area (square feet)		
Yield 1951	71.9	51.9
Left 1951	70.2	70.1
Growth 10 years[1]	40.7	38.4
Yield 10 years[1]	41.7	38.3
Left 1961	69.2	70.2
Total production[2]	182.8	160.4
Volume (cubic feet)[3]		
Yield 1951	1,245	635
Left 1951	1,020	1,220
Growth 10 years[1]	1,080	900
Yield 10 years[1]	825	720
Left 1961	1,275	1,400
Total production[2]	3,345	2,755
Volume (board feet)[4]		
Yield 1951	4,470	830
Left 1951	1,980	3,870
Growth 10 years[1]	5,860	5,440
Ingrowth	1,315	460
Yield 10 years[1]	3,615	2,870
Left 1961	4,225	6,440
Total production[2]	12,310	10,140
Number of trees		
Total trees	575	556
Cut 1951	227	329
Left 1951	348	227
Mortality	25	6
Cut 1961	77	91
Left 1961	246	130

1/ Includes mortality.
2/ Sum of the 1951 and 1961 yields plus the stand left in 1961.
3/ Gross peeled volume in cubic feet to a 3-inch top (d.i.b.).
4/ Gross volume to a 5-inch top (d.i.b.) (International 1/4-inch rule).

During the 10-year period, the cubic-foot-volume increase in the stands thinned from above was about 10 percent more than in the other stands (table 2). Ingrowth in stands thinned from above was more than 1,300 board feet, however, compared with 460 board feet in the other treatment.

FIGURE 3. — The difference in tree size of residual stands is obvious after two thinnings: This stand was thinned from above with an average tree size of 6.8 inches; This one was thinned from below with an average diameter of 9.8 inches.

THE AUTHORS

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